



BETTERBRICKS

# BUILDING COMMISSIONING

for better public buildings

## CASE STUDY

### MONROE CORRECTIONAL CENTER — ENSURING BUILDING PERFORMANCE OF EXPANDED HOUSING UNIT



*Aerial view of Monroe Correctional Center*

Expansion of the Special Offender Unit at Monroe Correctional Center was completed in 2002. This unit accepts inmates who have mental health issues. The new construction expanded the facility from 144 to 256 beds.

Shortly after construction began, the Washington State Department of Corrections (DOC), in conjunction with the Department of General Administration's building commissioning program, hired Casault Engineering to commission the heating, ventilating and air conditioning (HVAC) system, direct digital control (DDC) system, and fire/life safety system.

The commissioning process gave facility managers confidence that, at the end of the project, they were left with properly working mechanical and electrical systems. "Lessons learned" were that extra time and frustration were caused because the commissioning agent (CA) was not involved during the design phase, and because procedures for functional performance testing were not agreed to and specified up-front.

#### COMMISSIONING QUICK FACTS

Building Name	Special Offender Unit, Monroe Correctional Center
Location	Monroe, Washington
Project	New building construction
Commissioning Scope	HVAC, DDC, and fire/life safety systems
Building Size	112,566 sq.ft.
Total Construction Cost	\$33,300,000
Total Commissioning Cost	\$130,838
Commissioning as % of Construction Cost	0.4%
Commissioning Cost per Square Foot	\$1.16
First-Year Cost Benefit	\$20,900
Annual Energy Savings	\$16,100 per year

## PROJECT PARTNERS

**Washington State  
Department of General  
Administration**  
Roger Wigfield

**Washington State  
Department of Corrections**  
Tom Davis

**Casault Engineering**  
(Commissioning Agent)  
Rick Casault

**NBBJ**  
(Architect)  
Steve Delfelippi

**Hoffman Construction  
Company**  
(General Contractor)  
Glenn Anderson

**Abacus Engineered Systems**  
(Mechanical Engineer)  
Jim Harrison

## PROJECT SCOPE OF WORK

The following systems and their components were included in the commissioning scope of work:

- Air handling unit (AHU) and systems
- Variable frequency drives
- Exhaust fans and systems
- Direct expansion (DX) cooling systems
- Steam heat exchangers
- Heating water pumps and distribution systems
- Zone duct coils and terminal units
- Miscellaneous fan systems
- Fan coil units
- Unit heaters
- Fire alarm system including fire/smoke dampers
- HVAC controls
- System interfaces: HVAC controls, HVAC, fire alarm

## ISSUES IDENTIFIED

The CA identified many issues regarding HVAC control sequences of operation, bringing them to the attention of the design engineer and DDC contractor. For example:

- How to sequence bypass valves and variable speed drives in order to keep variable speed heating water pumps from operating too slowly, so as to not burn out the drives or motors.
- How to maintain stable heating water temperature control when the two steam-to-heating-water converters are staged on and off.
- Methodology for sequencing multiple stages of DX cooling in order to avoid cycling compressors too frequently, while minimizing over- and under-cooling as the compressors stage on and off.
- Control logic to use to reset air handling unit discharge air temperatures in order to maximize energy savings, while avoiding temporary deviation from room temperature setpoints.

Initial component functional testing revealed a number of deficiencies. For example:

- Outside air dampers for the AHU failed to the open position, rather than the specified closed position. Similarly, the AHU heating water coil valves failed to the closed position, rather than the specified open position. Both situations increased the potential for the coil to freeze if the AHU fails when outside temperatures are low.
- Temperature sensors not calibrated to the specified tolerances.

Other issues the CA identified and helped resolve include:

- Control of AHUs with unusually high minimum outside airflow rates
- Control of an unusually complex heating water distribution system
- Control of unit heaters and their fans, which were over-cycling
- Potential for freezing of fire sprinkler piping
- Fire/smoke damper control and deficient fire alarm components

## COMMISSIONING LESSONS LEARNED

Because the CA was not hired until after construction began, several stumbling blocks were encountered during the process.

For example, the design engineer, contractors, and CA had different interpretations of the commissioning scope of work and of the HVAC system's sequences of operation. The differing interpretations led to delays in functional performance testing, as well as additional expense for retesting. One result was that DOC awarded "Final Acceptance" of the project before all tests were complete, leaving several issues unresolved at the closeout of the commissioning process.

The CA offers the following recommendations for avoiding commissioning issues encountered in this project:

- Clearly document design intent and basis of design early in the design process.
- At schematic design, review the basis of systems design for simplicity and ability to understand and verify performance.
- In project specifications, include detailed descriptions of how each sequence of operation is to be implemented.
- In project specifications, include detailed descriptions of each functional performance test and its acceptance criteria.
- Require contractors to review the proposed functional test procedures and provide input regarding safety, equipment protection, test methods appropriate for materials and methods used, adherence to the contract documents, and suggestions for better or more efficient approaches.
- Require contractors to perform and record results of each functional performance test prior to scheduling a time for the CA to witness the tests.

## PROJECT BENEFITS

- \$20,900 in first-year cost benefits (such as fewer contractor call-backs, reduced change orders, problems corrected at design stage, etc.)
- \$16,100 in annual energy savings
- Issues identified helped avoid potential equipment damage
- Identified control sequences that maximize energy savings while maintaining comfort levels

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"I am satisfied that we received properly working systems. Any issues to this date have been of normal maintenance types, or warranty work."

Paddy Hescock  
Facilities Manager  
Monroe Correctional Center

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"Without commissioning the owner doesn't know the status of the mechanical and electrical systems and it is more difficult to get the contractors back during warranty to repair items that could have been found.

"Future projects will be commissioned. A lesson learned is to get the CA on board during design... DOC is committed to future buildings meeting the LEED silver rating which requires commissioning."

Tom Davis, P. E.  
Washington State Department of Corrections

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## WHAT IS COMMISSIONING?

Building commissioning is a systematic and documented process of ensuring that building systems perform according to the design intent and the owner's operational needs.

Commissioning is used in both new construction and existing buildings.

Commissioning:

- Provides a better environment for occupants
- Reduces indoor air quality problems
- Reduces occupant complaints
- Reduces contractor call-backs and warranty issues
- Reduces energy consumption and operational costs

## FOR INFORMATION ON WASHINGTON'S COMMISSIONING PROGRAM



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**Technical Writing/Editing**  
Washington State University  
Extension Energy Program

*Fall 2003*